Appl. No. 09/922,065 Resp./Amdt. dated Oct. 14, 2005 Reply to Office Action of 07/27/2005

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

Claim 1 (Original): A method of compensating for phase noise added by a spectrum analyzer to measurements of phase noise of a signal under test (SUT) taken by the spectrum analyzer, the method comprising the step of:

applying a correction to a measured phase noise $\mathcal{L}(f_m)$ value for the SUT to determine an actual phase noise $\mathcal{L}_A(f_m)$ value for the SUT, wherein the correction comprises mathematically removing an added phase noise $\mathcal{L}_{SA}(f_m)$ value contributed by the spectrum analyzer from the measured phase noise $\mathcal{L}(f_m)$ value of the SUT.

Claim 2 (Previously Presented): The method of Claim 1 wherein the mathematical correction and the actual phase noise $\mathcal{L}_{A}(f_{m})$ value is given by

$$\mathcal{L}_{A}(f_{m}) = 10\log\left(10^{\frac{\mathcal{L}(f_{m})}{10}} - 10^{\frac{\mathcal{L}_{SA}(f_{m})}{10}}\right)$$

wherein the term f_m is an offset frequency.

Claim 3 (Original): The method of Claim 1 further comprising the step of measuring phase noise $\mathcal{L}(f_m)$ values of the SUT at a plurality of offset frequencies f_m prior to performing the step of applying the correction.

Claim 4 (Original): The method of Claim 3 wherein the step of measuring comprises averaging a plurality of measurements of the phase noise $\mathcal{L}(f_m)$ values corresponding to each offset frequency f_m .

Claim 5 (Original): The method of Claim 1 further comprising the step of displaying the corrected actual phase noise $\mathcal{L}_A(f_m)$ data.

Appl. No. 09/922,065 Resp./Amdt. dated Oct. 14, 2005 Reply to Office Action of 07/27/2005

The method of Claim 1 further comprising the step of Claim 6 (Original): determining the added phase noise $\mathcal{L}_{SA}(f_m)$ value of the spectrum analyzer at a plurality of offset frequencies f_m .

The method of Claim 6, wherein the step of determining Claim 7 (Original): comprises the step of extracting the added phase noise $\mathcal{L}_{SA}(f_m)$ value of the spectrum analyzer from data supplied by a manufacturer of the spectrum analyzer.

The method of Claim 6, wherein the step of determining Claim 8 (Original): comprises the step of extracting the added phase noise $\mathcal{L}_{SA}(f_m)$ value of the spectrum analyzer from added phase noise $\mathcal{L}'_{SA}(f_m)$ specification data for a class of spectrum analyzers to which the spectrum analyzer belongs.

The method of Claim 6, wherein the step of determining Claim 9 (Original): comprises the steps of:

generating a reference signal having a phase noise $\mathcal{L}_{ref}(f_m)$;

measuring a phase noise $\mathcal{L}_{ref}(f_m)$ value of the reference signal at each of the offset frequencies f_m with the spectrum analyzer; and

computing the added phase noise $\mathcal{L}_{SA}(f_m)$ value of the spectrum analyzer from the measured reference signal phase noise $\mathcal{L}_{ref}(f_m)$ value at each of the offset frequencies f_m .

The method of Claim 9, wherein the measured reference Claim 10 (Original): signal phase noise $\mathcal{L}_{rel}(f_m)$ value is the added phase noise $\mathcal{L}_{SA}(f_m)$ value of the spectrum analyzer.

The method of Claim 9, wherein the step of computing Claim 11 (Original): comprises subtracting a known reference signal phase noise $\mathcal{L}'_{ref}(f_m)$ value from the measured reference signal phase noise $\mathcal{L}_{ref}(f_m)$ value according to

$$\mathcal{L}_{SA}(f_m) = 10\log\left[10\frac{\mathcal{L}_{\omega p}(f_m)}{10} - 10\frac{\mathcal{L}_{ref}(f_m)}{10}\right]$$

(775) 849-3143

Appl. No. 09/922,065 Resp./Amdt. dated Oct. 14, 2005 Reply to Office Action of 07/27/2005

Oct 14 2005 9:27AM

to yield the added phase noise $\mathcal{L}_{SA}(f_m)$ value of the spectrum analyzer at an offset frequency f_m .

Claim 12 (Cancelled).

The method of Claim 2 further comprising the steps of: Claim 13 (Original): measuring the phase noise $\mathcal{L}(f_m)$ value of the SUT at a plurality of offset frequencies f_m ; and

determining the added phase noise $\mathcal{L}_{SA}(f_m)$ value of the spectrum analyzer at each of the offset frequencies f_m ,

wherein the step of measuring and the step of determining are performed prior to performing the step of applying the correction.

The method of Claim 13, wherein the step of Claim 14 (Original): determining comprises the steps of:

generating a reference signal having a phase noise $\mathcal{L}_{ref}(f_m)$;

measuring a phase noise $\mathcal{L}_{ref}(f_m)$ value of the reference signal at each of the offset frequencies f_m with the spectrum analyzer, wherein the measured phase noise $\mathcal{L}_{ref}(f_m)$ value of the reference signal is the determined added phase noise $\mathcal{L}_{SA}(f_m)$ value of the spectrum analyzer.

Claim 15 (Cancelled).

The method of Claim 13, wherein the step of Claim 16 (Original): determining comprises the step of extracting the added phase noise $\mathcal{L}_{SA}(f_m)$ value of the spectrum analyzer from data supplied by a manufacturer of the spectrum analyzer.

The method of Claim 13, wherein the step of Claim 17 (Original): determining comprises the step of extracting the added phase noise $\mathcal{L}_{SA}(f_m)$ value of the spectrum analyzer from added phase noise $\mathcal{L}'_{SA}(f_m)$ specification data for a class of spectrum analyzers to which the spectrum analyzer belongs.

Claim 18 (Cancelled).

Appl. No. 09/922,065 Resp./Amdt. dated Oct. 14, 2005

Reply to Office Action of 07/27/2005

A method of determining an actual phase Claim 19 (Previously Presented): noise of a signal under test (SUT), the method comprising:

measuring phase noise of a spectrum analyzer under reference conditions to obtain an added phase noise value;

measuring phase noise of the SUT using the spectrum analyzer to obtain a measured phase-noise value; and

calculating an actual phase noise according to

$$\mathcal{L}_{A}(f_{m}) = 10\log\left(10^{\frac{\mathcal{L}(f_{m})}{10}} - 10^{\frac{\mathcal{L}_{SA}(f_{m})}{10}}\right)$$

wherein the term $\mathcal{L}_A(f_m)$ is the actual phase noise value at an offset frequency f_m , and the terms $\mathcal{L}(f_m)$ and $\mathcal{L}_{SA}(f_m)$ are the measured phase noise value of the SUT and the added phase noise value of the spectrum analyzer at the offset frequency f_m , respectively.

The method of Claim 19, wherein Claim 20 (Previously Presented): measuring phase noise of the spectrum analyzer under reference conditions comprises:

generating a reference signal;

measuring a phase noise $\mathcal{L}_{ref}(f_m)$ value of the reference signal at each of the offset frequencies f_m with the spectrum analyzer; and

computing the added phase noise $\mathcal{L}_{SA}(f_m)$ value of the spectrum analyzer from the measured reference signal phase noise $\mathcal{L}_{ref}(f_m)$ value at each of the offset frequencies f_m .

Claim 21 (Cancelled).

Claim 22 (Previously Presented): The method of Claim 20, wherein computing comprises subtracting a known reference signal phase noise $\mathcal{L}'_{ref}(f_m)$ value from the measured reference signal phase noise $\mathcal{L}_{ref}(f_m)$ value according to

Appl. No. 09/922,065 Resp./Amdt. dated Oct. 14, 2005 Reply to Office Action of 07/27/2005

$$\mathcal{L}_{SA}(f_m) = 10 \log \left(10^{\frac{\mathcal{L}_{ref}(f_m)}{10}} - 10^{\frac{\mathcal{L}'_{ref}(f_m)}{10}} \right)$$

to yield the added phase noise $\mathcal{L}_{SM}(f_m)$ value of the spectrum analyzer at the offset frequency f_m .

Claim 23 (Currently Amended): A spectrum analyzer apparatus that corrects for added phase noise contributed by the spectrum analyzer in measurements of phase noise of a signal under test, the apparatus comprising:

a signal conversion and detection portion that measures phase noise $\mathcal{L}(f_m)$ data of the signal under test;

a memory portion that provides data and information storage;

a controller portion that controls the signal conversion and detection portion; and

a compensation algorithm stored in the memory portion and executed by the controller portion, wherein the executed compensation algorithm applies a mathematical correction to the measured phase noise $\mathcal{L}(f_m)$ data of the signal under test, the correction comprising a compensation for the added phase noise $\mathcal{L}_{SA}(f_m)$ data in the measured phase noise $\mathcal{L}(f_m)$ data to produce actual phase noise $\mathcal{L}_A(f_m)$ data for the signal under test.

Claim 24 (Previously Presented): The apparatus of Claim 23 wherein the mathematical correction and the actual phase noise $\mathcal{L}_A(f_m)$ data is given by

$$\mathcal{L}_{A}(f_{m}) = 10\log\left(10^{\frac{\mathcal{L}(f_{m})}{10}} - 10^{\frac{\mathcal{L}_{M}(f_{m})}{10}}\right)$$

where f_m is an offset frequency.

Claim 25 (Original): The apparatus of Claim 23, wherein the memory portion comprises the added phase noise $\mathcal{L}_{SA}(f_m)$ data that is used by the compensation algorithm.

Appl. No. 09/922,065 Resp./Amdt. dated Oct. 14, 2005 Reply to Office Action of 07/27/2005

Claim 26 (Original): The apparatus of Claim 25, wherein the added phase noise $\mathcal{L}_{SA}(f_m)$ data is measured by the signal conversion and detection portion.

Claim 27 (Previously Presented): A system that compensates for phase noise added by a spectrum analyzer from phase noise measurements of a signal under test (SUT), the system comprising:

a spectrum analyzer that measures phase noise $\mathcal{L}(f_m)$ data of the signal under test; and

a controller that mathematically corrects the phase noise $\mathcal{L}(f_m)$ data of the SUT measured by the spectrum analyzer to produce actual phase noise $\mathcal{L}_A(f_m)$ data for the SUT.

Claim 28 (Original): The system of Claim 27, wherein the controller comprises a control algorithm that mathematically removes added phase noise $\mathcal{L}_{SA}(f_m)$ data contributed by the spectrum analyzer from the measured phase noise $\mathcal{L}(f_m)$ data of the signal under test.

Claim 29 (Previously Presented): The system of Claim 28, wherein the controller further comprises:

a memory;

a central processing unit (CPU), wherein the control algorithm is stored in the memory and executed by the CPU; and

an input/output interface that interfaces with the spectrum analyzer,

wherein the executed control algorithm receives the measured phase noise $\mathcal{L}(f_m)$ data for the SUT from the spectrum analyzer using the interface, and wherein the control algorithm implements

$$\mathcal{L}_{A}(f_{m}) = 10\log\left(10^{\frac{\mathcal{L}(f_{m})}{10}} - 10^{\frac{\mathcal{L}_{SA}(f_{m})}{10}}\right)$$

to compensate for the added phase noise $\mathcal{L}_{SA}(f_m)$ data contributed by the spectrum analyzer from the measured phase noise $\mathcal{L}(f_m)$ data of the signal under test to produce

Appl. No. 09/922,065 Resp./Amdt. dated Oct. 14, 2005 Reply to Office Action of 07/27/2005

the actual phase noise $\mathcal{L}_A(f_m)$ data for the signal under test, where f_m is an offset frequency.

Claim 30 (Original): The system of Claim 29, wherein the executed control algorithm further controls the spectrum analyzer using the interface during a phase noise measurement of the signal under test.

Claim 31 (Previously Presented): A spectrum analyzer comprising: a signal conversion and detection portion that measures phase noise $\mathcal{L}(f_m)$ of a signal under test at an offset frequency f_m ;

a memory portion that provides data and information storage;

a controller portion that controls the signal conversion and detection portion; and

a compensation program stored in the memory portion and executed by the controller portion, the executed compensation program applying a mathematical correction to the measured phase noise $\mathcal{L}(f_m)$ to produce an actual phase noise $\mathcal{L}_{\mathcal{A}}(f_m)$ for the signal under test, the correction comprising compensation for added phase noise $\mathcal{L}_{SA}(f_m)$ associated with the spectrum analyzer in the measured phase noise $\mathcal{L}(f_m)$, the added phase noise $\mathcal{L}_{SA}(f_m)$ being either determined by measuring a reference signal phase noise $\mathcal{L}_{ref}(f_m)$ value with the spectrum analyzer and removing from the reference signal phase noise $\mathcal{L}_{ref}(f_m)$ an a priori known reference signal phase noise $\mathcal{L}'_{ref}(f_m)$ value or determined from spectrum analyzer phase noise data supplied by a manufacturer of the spectrum analyzer.

The method spectrum analyzer of Claim Claim 32 (Currently Amended): 31, wherein the mathematical correction and the actual phase noise $\mathcal{L}_A(f_m)$ data are given by

$$\mathcal{L}_{\mathcal{A}}(f_m) = 10\log\left(10^{\frac{\mathcal{L}(f_m)}{10}} - 10^{\frac{\mathcal{L}_{Sd}(f_m)}{10}}\right)$$

Appl. No. 09/922,065 Resp./Amdt. dated Oct. 14, 2005 Reply to Office Action of 07/27/2005

and wherein removing comprises subtracting the known reference signal phase noise $\mathcal{L}'_{ref}(f_m)$ value from the measured reference signal phase noise $\mathcal{L}_{ref}(f_m)$ value according to

$$\mathcal{L}_{SA}(f_m) = 10\log\left(10^{\frac{\mathcal{L}_{ref}(f_m)}{10}} - 10^{\frac{\mathcal{L}_{ref}(f_m)}{10}}\right)$$

to yield the added phase noise $\mathcal{L}_{SA}(f_m)$ of the spectrum analyzer.

Claim 33 (Previously Presented): The spectrum analyzer of Claim 31, wherein the *a priori* known reference signal phase noise $\mathcal{L}'_{re}(f_m)$ is either derived from data provided by a manufacturer of the reference source or measured independently of measuring the reference signal phase noise $\mathcal{L}_{re}(f_m)$ value using the spectrum analyzer.

Claim 34 (Previously Presented): The spectrum analyzer of Claim 31, wherein the added phase noise $\mathcal{L}_{SA}(f_m)$ is determined from added phase noise $\mathcal{L}_{SA}(f_m)$ specification data for a class of spectrum analyzers to which the spectrum analyzer belongs.